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Item 6 (d) of the provisional agenda
Autonomous/automated and connected vehicles:
Automatically Commanded Steering Function

Proposal for a Supplement to UN Regulation No. 79 (Steering Equipment)

Submitted by the experts from the International Organization of Motor Vehicle Manufacturers and European Association of Automotive Suppliers**

The text reproduced below was prepared by the experts from the International Organization of Motor Vehicle Manufacturers (OICA) and European Association of Automotive Suppliers (CLEPA). It contains a proposal for amendments to the requirements for Automatically Commanded Steering Functions (ACSF) of Category C, which has been presented at the meeting of the Informal Working Group (IWG) on ACSF in Tokyo in January 2018. This text proposes specific provisions for the use of a lane change function with a so-called two-step Human Machine Interface (HMI). The original proposal has been amended, taking into account the comments received from contracting parties. The modifications to the existing text of the Regulation (in ECE/TRANS/WP29/2018/35) are marked in tracked changes.

* Formerly: **Working Party on Brakes and Running Gear (GRRF)**.

** In accordance with ECE/TRANS/274, para 52), with ECE/TRANS/WP.29/1139, para. 33 and with the programme of work of the Inland Transport Committee for 2014–2018 (ECE/TRANS/240, para. 105 and ECE/TRANS/2014/26, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

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I. Proposal

Paragraph 5.6.4.6.4., amend to read:

"5.6.4.6.4. The lateral movement of the vehicle towards the intended lane shall not start earlier than 1 **second** after the start of the lane change procedure. Additionally, the lateral movement to approach the lane marking and the lateral movement necessary to complete the lane change manoeuvre shall be completed as one continuous movement.

~~The lane change manoeuvre shall not be initiated before a period of 3.0 seconds and not lat. than 5.0 seconds after the deliberate action of the driver described in paragraph 5.6.4.6.2. above~~.

The lateral movement may be initiated automatically or by a second deliberate action of the driver.

The lane change manoeuvre shall commence not earlier than 3 seconds and

(a) Not later than 5.0 seconds with an automatic initiation, or

(b) Not later than 7.0 seconds with an initiation by a second deliberate action,

Following the deliberate action of the driver to start the procedure described in paragraph 5.6.4.6.2.

The second deliberate action shall be performed at the latest 4 seconds after the lane change procedure.

The control to operate the second deliberate action shall be located in the steering control area."

Paragraph 5.6.4.6.7., amend to read:

"5.6.4.6.7. The direction indicator shall remain active throughout the whole period of the lane change manoeuvre and shall be deactivated by the system no later than 0.5 seconds after the resumption of ACSF of Category B1 lane keeping function as described in paragraph 5.6.4.6.6 above. **Automatic deactivation of the direction indicator is only required if the lane change manoeuvre is initiated automatically without a second deliberate action.**"

Paragraph 5.6.4.6.8.1., amend to read:

"5.6.4.6.8.1. The lane change procedure shall be suppressed automatically by the system when at least one of the following situations occurs before the lane change manoeuvre has started:

(a) The system detects a critical situation (as defined in paragraph 5.6.4.7),

(b) The system is overridden or switched off by the driver,

(c) The system reaches its boundaries (e.g., lane markings are no longer detected),

(d) The system has detected that the driver is not holding the steering control at the start of the lane change manoeuvre,

(e) The direction indicator lamps are manually deactivated by the driver,

(f) ~~The lane change manoeuvre has not commenced within 5.0 seconds following the deliberate action of the driver described in paragraph 5.6.4.6.2.;~~ **Following the deliberate action of the driver to start the procedure described in paragraph 5.6.4.6.2., the lane change manoeuvre has not commenced:**

(a) At the latest after 5.0 seconds with an automatic initiation,

(b) At the latest after 7.0 seconds with an initiation by a second deliberate action,

Whatever is appropriate.

(g) The system, with an initiation of the lane change manoeuvre by a second deliberate action, has not detected the second deliberate action at least 4.0 seconds after the start of the procedure.

(ge) The lateral movement described in paragraph 5.6.4.6.4. is not continuous.

Annex 8,

Paragraph 3.5.1.2., amend to read:

"3.5.1.2. The requirements of the test are fulfilled if:

(a) The lateral movement towards the marking does not start earlier than 1 second after the lane change procedure was initiated,

(b) The lateral movement to approach the lane marking and the lateral movement necessary to complete the lane change manoeuvre are completed as one continuous movement,

(c) The recorded lateral acceleration does not exceed 1m/s^2,

(d) The moving average over half a second of the lateral jerk does not exceed 5 m/s^3,

(e) The measured time between the start of the lane change procedure and the start of the lane change manoeuvre is not less than 3.0 s and not more than:

(i) 5.0 seconds **with an automatic initiation**,

(ii) 7.0 seconds with an initiation by a second deliberate action

whatever is appropriate.

(f) For systems, with an initiation of the lane change manoeuvre by a second deliberate action, the measured time between the start of the lane change procedure and the second deliberate action is not more than 4.0 seconds.

(f g) The system provides an information to the driver to indicate that the lane change procedure is on-going,

(g h) The lane change manoeuvre is completed in less than 5 s for M_1, N_1 vehicle categories and less than 10 s for M_2, M_3, N_2, N_3 vehicle categories,

(h i) ACSF of Category B1 automatically resumes after the lane change procedure is completed, and

(i j) The direction indicator is deactivated not before the end of the lane change manoeuvre and no later than 0.5 seconds after B1 has resumed, **in case the lateral movement is initiated automatically.**"

Paragraph 3.5.4.1., amend to read:

"3.5.4.1. The test vehicle shall be driven in a lane of a straight test track, which has at least two lanes in the same direction of travel, with road markings on each side of the lanes.

The vehicle speed shall be: V_{smin} + 10km/h.

The ACSF of Category C shall be activated (standby mode) and another vehicle shall approach from the rear in order to enable the system as specified in paragraph 5.6.4.8.3. above.

The approaching vehicle shall then pass the vehicle under test entirely.

A Lane Change Procedure shall then be initiated by the driver.

The test shall be repeated for each of the following conditions, which shall occur before the lane change manoeuvre has started:

(a) The system is overridden by the driver;

(b) The system is switched off by the driver;

(c) The vehicle speed is reduced to: V_{smin}-10 km/h;

(d) The driver has removed his hands from the steering control and the hands-off warning has been initiated;

(e) The direction indicator lamps are manually deactivated by the driver;

(f) The lane change manoeuvre has not commenced within 5.0 s following the initiation of the lane change procedure. (e.g., another vehicle is driving in the adjacent lane in a critical situation as described in 5.6.4.7.) **or 7.0 seconds if initiated by a second deliberate action.**

(g) For a system with an initiation of the lane change manoeuvre by a second deliberate action, the driver has performed the second deliberate action more than 4.0 seconds after the initiation of the lane change procedure."

Paragraph 3.5.7.1.1., amend to read:

"3.5.7.1.1. Following a new engine start /run cycle performed by the driver, the test vehicle shall be driven in a lane of a straight test track, which has at least two lanes in the same direction of travel, with road markings on each side of the lanes.

The ACSF of Category C shall not be activated (off mode) and another vehicle shall approach from the rear and the approaching vehicle shall pass the vehicle entirely.

~~The direction indicator used to initiate a lane change procedure shall be activated by the driver for a period greater than 5 seconds.~~

A lane change procedure and manoeuvre shall then be initiated by the driver with the appropriate deliberate action(s)."

Paragraph 3.5.7.2.1., amend to read:

"3.5.7.2.1. Following a new engine start / run cycle performed by the driver, the test vehicle shall be driven in a lane of a straight test track, which has at least two lanes in the same direction of travel, with road markings on each side of the lanes.

The ACSF of Category C shall be manually activated (standby mode).

A lane change procedure **and manoeuvre** shall then be initiated by the driver **with the appropriate deliberate action(s).**"

Paragraph 3.5.7.3.1., amend to read:

"3.5.7.3.1. Following the completion of the test phase 2, another vehicle shall approach from the rear on the adjacent lane in order to enable the system as specified in paragraph 5.6.4.8.3.

The approaching vehicle shall be a type approved high volume series production vehicle.

The distance between the rear end of the test vehicle and the front end of the approaching vehicle shall be measured (e.g. with a differential GPS), and the value when the system detects the approaching vehicle be recorded.

After the rear coming vehicle has entirely passed the vehicle under test, a lane change procedure **and manoeuvre** shall be initiated by the driver **with the appropriate deliberate action(s).**"

II. Justification

A. Introduction

1. This proposal does not at all change the current requirements for ACSF of Category C (ACSF-C) with the one-step HMI.

2. The proposal is to insert provisions for ACSF-C with a two-step HMI, while keeping unchanged the main performance of the system e.g. rear sensor range, critical situations, minimum distance and minimum operating speed, etc.

B. Proposal

Paragraph 5.6.4.6.4.

3. For the lane change function with one-step HMI, the lane change manoeuvre shall be initiated between ti e third and the fifth second after the initiation of the lane change procedure.

4. The lane change function with two-step HMI is a quite natural HMI, closer to manual lane change: the driver has full control on the timing of the two steps of a lane change, i.e. initiating the lane change procedure, then initiating the lateral movement, by two deliberate actions.

5. This permits an increase in the maximum time between the Lane Change Procedure and the Lane Change Manoeuvre.

6. So, it is proposed to initiate the lateral movement of the vehicle after the second deliberate action.

7. This second action shall be performed at the latest 4 seconds after the start of the lane change procedure. The lane change manoeuvre shall be initiated at the latest seven seconds after the initiation of the lane change procedure.

8. The driver will have to perform two different actions in a short time frame. Moreover, the driver should still continue to drive and be supervising the environment. That's why it is important that the control for the second deliberate action shall be located close to the steering control area (e.g.: Push button on the steering wheel….).

Paragraph 5.6.4.6.7.

9. As the lane change function with two-step HMI is closer to a manual lane change, we propose to keep the possibility for this function to have an automatic or a manual deactivation of the direction indicator. This system is a "SAE level 2" system and a hands-on function. The manual lane change and the two-step HMI function proposed an optic and an acoustic signal provided by the turn indicator function.

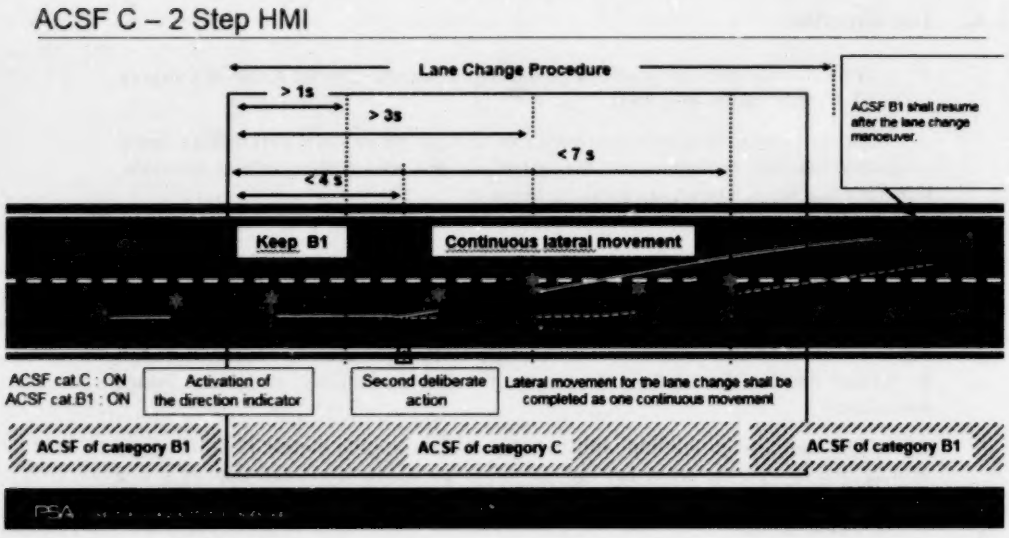
Paragraph 5.6.4.6.8.1.

10. This paragraph describes the conditions that lead to an automatic suppression of the lane change procedure. For the lane change with two-step HMI, the lane change manoeuvre shall commence before the tenth second. Otherwise, the lane change procedure shall be suppressed and the ACSF of Category B1 shall resume.

Annex 8:

The testing procedure is then adapted according to the above requirements.

Figure 1
Description of the two-step HMI lane change procedure


ACSF C – 2 Step HMI
Lane Change Procedure
> 1s
> 3s
< 7 s
< 4 s
ACSF B1 shall resume after the lane change manoeuver.
Keep B1
Continuous lateral movement
ACSF cat.C : ON
ACSF cat.B1 : ON
Activation of the direction indicator
Second deliberate action
Lateral movement for the lane change shall be completed as one continuous movement
ACSF of category B1
ACSF of category C
ACSF of category B1